Remarks:

Claims 1-26 and 33-36 remained pending in the application.

Claims 1, 2, 10, 11, 18, 19 and 21 stand rejected under 35 U.S.C. §103(a) based on Slysh (US 5,147,680) in view of either Taylor et al. (J. Appl. Phys. 64 (5)) or Owen et al. (US 5593,606).

Claims 1-5, 7-21, 25, 26 and 33-36 stand rejected under 35 U.S.C. §103(a) based on Drazl (US 6,565,927) in view of either Taylor et al. or Owen et al.

Applicants respectfully traverse these rejections, and in view of the remarks below, respectfully request reconsideration of the application under 37 C.F.R. § 1.111 and allowance of the pending claims.

Rejections Under 35 U.S.C. §103(a)

As noted above, claims 1, 2, 10, 11, 18, 19 and 21 stand rejected under 35 U.S.C. §103(a) based on Slysh (US 5,147,680) in view of either Taylor et al. (J. Appl. Phys. 64 (5)) or Owen et al. (US 5593,606).

The Examiner asserts that Slysh teaches roughening of a substrate by irradiating the surface with a laser in order to increase the adhesion of a layer to be applied. The Examiner further asserts that Slysh teaches use of a mask to control the areas of ablation, but that the "reference is silent to resettling the ablation debris." The Examiner thus cites Taylor et al. and/or Owen et al. to teach selecting laser fluence such that some of the debris is re-deposited onto the substrate.

Applicants respectfully disagree with the Examiner's indication that Slysh teaches irradiating the surface of a substrate to roughen the substrate, disagrees with the Examiner's indication that Slysh is silent as to resettling ablation debris, and disagrees with the Examiner's characterization of Taylor et al. and Owen et al. None of the cited references, either alone or in combination, disclose or suggest using ablation debris to shadow a portion of a substrate from further laser ablation, as recited in applicants' claims.

While applicants acknowledge that Slysh discloses use of a maskant on a workpiece, applicants note that the purpose of the laser beam is "to disintegrate the excess maskant" and to "shape[] the edges of the maskant" (column 2, lines 4-18). Thereafter, the workpiece is chemically milled to produce ribs on the workpiece (column 5, lines 2-6; Fig. 5). Slysh does not disclose or suggest use of laser ablation to roughen a surface of a substrate.

Regarding the Examiner's assertion that Slysh is "silent to resettling ablation debris," applicants note that Slysh expressly describes use of "circulating air currents [that] are directed to entrain and remove maskant volatile product and debris generated by the interaction of the laser beams with the maskant spray and deposited strip" (column 3, lines 29-32). Slysh thus specifically directs removal of debris from the workpiece so as to allow laser-disintegration and laser-shaping of the maskant. Any modification of Slysh to resettle debris on the substrate (as the Examiner proposes) thus would be contrary to the teaching of Slysh, and thus is improper in rejecting applicants' claims.

Taylor et al. indicates that debris cones may undesirably be formed during laser ablation of a substrate, but that such debris formation may be eliminated by increasing laser fluence. Taylor et al. thus specifically seeks to identify a mechanism for avoiding settling of ablation debris on a substrate. Accordingly, Taylor et al. also teaches contrary to the Examiner's proposed modification of Slysh to resettle debris on the substrate, and the proposed combination of Slysh and Taylor et al. is improper in rejecting applicants' claims.

Owen et al. discloses a solid-state laser system for forming vias in a substrate. Owen et al. notes that a plume produced by the initial beam pulse undesirably causes the saturation depth phenomenon, thereby shielding beam pulses of power density above a certain level from having any enhanced cut effect. Contrary to the Examiner's assertion, Owen et al. does not disclose resettling of debris on the substrate, but rather, refers to a plume produced by an initial beam pulse. In fact, Owen et al. specifically relies on the absence of the resettling of debris, calling for directing the output beam in a pattern that avoids the power-muting effect of the plume. Owen et al. thus teaches contrary to the Examiner's proposed modification of Slysh to resettle debris on the substrate, and the proposed combination of Slysh and Owen et al. is improper in rejecting applicants' claims.

Applicants thus respectfully submit that the rejections of claims 1, 2, 10, 11, 18, 19 and 21 stand rejected under 35 U.S.C. §103(a) based on Slysh in view of either Taylor et al. or Owen et al. should be withdrawn.

Referring to the particular claims, applicants note that claim 1 recites:

> A method of preparing a surface for adhesion, the method comprising:
> providing an initiator in the form of precursors of structures formed by ablation of a substrate which is configured to shadow a portion of a surface of the substrate;
> directing a laser toward the surface of the substrate to effect ablation of a non-shadowed portion of the substrate, forming structures on the surface of the substrate; and
> applying an adhesive to the surface of the substrate.

As noted generally above, Slysh does not disclose "providing an initiator in the form of precursors of structures formed by ablation of a substrate." In fact, Slysh proposes using lasers to disintegrate a maskant applied to a workpiece (substrate), and the use of circulating air currents to remove any volatile product and debris. Taylor et al. and Owen et al. also fail in this regard. Taylor indicates only that "higher fluences will be required to remove cone formation." Owen et al. refers only to an undesirable plume of debris that may be avoided by directing the beam in a pattern.

Slysh also fails to disclose debris (precursors of structures formed by ablation) that "shadow[s] a portion on a surface of the substrate." The Examiner indicates that Slysh is silent as to resettling of ablation debris. However, as noted above, Slysh specifically describes "circulating air currents" that remove any debris formed by ablation (column 3, lines 29-32). Slysh thus actually teaches away from the method recited in claim 1. Taylor et al. and Owen et al. also teach away from the proposed debris that "shadow[s] a portion on a surface of the substrate." Taylor et al. teaches increasing laser fluence to avoid such debris. Owen et al. teaches directing the beam in a pattern to avoid a temporary plume of debris.

Slysh also fails to disclose "ablation of a non-shadowed portion of the substrate" so as to form structures on the surface of the substrate. As noted above, Slysh describes using lasers to disintegrate the maskant, not the workpiece underlying the maskant. In fact, as illustrated in Fig. 1 of Slysh, and as described in column 4, lines 42-49, laser energy is selected such that the workpiece absorbs laser energy. The laser thus does not "form[] structures on the surface of the substrate," as recited in claim 1. Taylor et al. and Owen et al. also teach away from the proposed "forming structures on the surface of the substrate." Taylor et al. teaches increasing laser fluence to avoid such debris. Owen et al. makes no reference to any debris on the surface of the substrate, but in a temporary plume of debris above the substrate.

Finally, Slysh fails to disclose "applying an adhesive to the surface of the substrate." Slysh concerns nothing more than applying a maskant to a workpiece for subsequent chemical milling of the workpiece. Taylor et al. and Owen et al. provide nothing further in this regard.

For at least the foregoing reasons, claim 1 is not rendered obvious by Slysh, either alone, or in combination with Taylor et al. and/or Owen et al. Claim 1 thus is allowable, and the rejection of claim 1 under 35 U.S.C. §103(a) should be withdrawn. Claim 2 depends from claim 1, and thus is allowable for at least the same reasons as claim 1.

Claim 10 recites:

> A method of preparing a surface for adhesion, the method comprising:
> directing laser radiation towards the surface of the substrate to effect ablation of the substrate and create ablation debris, the ablation debris having a higher ablation threshold than the surface of the substrate;
> resettling the ablation debris on the substrate surface to shadow a portion of the surface from laser radiation;
> further directing laser radiation towards the surface of the substrate at an intensity sufficient to cause ablation of the substrate, but not sufficient to cause substantial ablation of the debris, thereby forming structures on the surface of the substrate.

As noted generally above with respect to claim 1, Slysh, Taylor et al. and Owen et al. all fail to disclose "resettling the ablation debris on the substrate surface to shadow a portion of the surface from laser radiation," as recited in claim 10. In fact, all three of the cited references expressly proposes to avoid such resettling of ablation debris.

The cited references also fail to disclose a laser having an "intensity sufficient to cause ablation of the substrate, but not sufficient to cause substantial ablation of the debris." Slysh and Taylor fail to select laser intensity to ablate the substrate (but not the debris) because both call for removal of the debris. Owen et al. does not even consider such distinction because Owen et al. does not consider debris other than in a plume that Owen et al. seeks to avoid.

For at least the foregoing reasons, claim 10 is not rendered obvious by Slysh, either alone, or in combination with Taylor et al. and/or Owen et al. Claim 10 thus is allowable, and the rejection of claim 10 under 35 U.S.C. §103(a) should be withdrawn. Claim 11 depends from claim 10, and thus is allowable for at least the same reasons as claim 10.

Claim 18 recites:

A method of increasing adhesion of an adhesive to a substrate, the method comprising:
directing a laser at a surface of a substrate to cause ablation of the surface and formation of ablation debris;
adjusting the fluence of the laser between an ablation threshold of the substrate and an ablation threshold of the ablation debris;
ablating the surface of the substrate;
progressively covering the surface of the substrate with ablation debris to effect formation of raised structures on the surface of the substrate; and
applying an adhesive to the surface of the substrate.

As noted generally above with respect to claims 1 and 10, Slysh, Taylor et al. and Owen et al. fail to disclose "directing a laser at a surface of the substrate to cause ablation of the surface and formation of ablation debris." There also is no disclosure of "applying an adhesive to the surface of the substrate," as recited in claim 18. As noted above, the references also fail to adjust laser fluency to ablate the substrate (but not the debris) because they call for removal of the debris. Accordingly, the references fail to disclose "progressively covering the surface of the substrate with ablation debris to effect formation of raised structures on the surface of the substrate," as recited in claim 18.

For at least the foregoing reasons, claim 18 is not rendered obvious by Slysh, either alone, or in combination with Taylor et al. and/or Owen et al. Claim 18 thus is allowable, and the rejection of claim 18 under 35 U.S.C. §103(a) should be withdrawn. Claim 19 depends from claim 18, and thus is allowable for at least the same reasons as claim 18.

Claim 21 recites:

> A method of eliminating interfacial failure between a first component and an adhesive in a print cartridge assembly, the method comprising:
> directing a laser at a surface of a first component;
> shadowing a portion of the surface of the first component with precursors of structures formed by ablation of the surface of the first component to form a high threshold ablation region and a low threshold ablation region;
> adjusting the laser to ablate the low threshold ablation region at a rate faster than ablation of the high threshold ablation region in order to form structures on the surface of the first component; and
> applying an adhesive to the surface of the first component.

As noted generally above, the cited references fail to disclose "adjusting the laser to ablate the low threshold ablation region at a rate faster than ablation of the high threshold ablation region in order to form structures on the surface of the first component." In fact, there would be no reason in any of the references to do so as they each call for removal of the debris. The references also fail to disclose "shadowing a portion of the surface of the first component with precursors of structures formed by ablation of the surface of the first component to form a high threshold ablation region and a low threshold ablation region" or of "applying an adhesive to the surface of the substrate," as recited in claim 21.

For at least the foregoing reasons, claim 21 is not rendered obvious by Slysh, either alone, or in combination with Taylor et al. and/or Owen et al. Claim 21 thus is allowable, and the rejection of claim 21 under 35 U.S.C. §103(a) should be withdrawn.

As noted above, claims 1-26 and 33-36 stand rejected under 35 U.S.C. §103(a) based on Drzal (US 6,565,927) in view of either Taylor et al. or Owen et al. In support of this rejection, the Examiner has indicated that Drzal teaches patterning of a substrate by

irradiating the surface with UV light in order to increase adhesion of a layer to be applied. The Examiner asserts that the "water, ozone, organic particles taught in column 3, lines 28-45 reads on being the initiator."

The Examiner acknowledges that Drazl et al. does not teach that the optical energy is in the form of a laser, and thus cites Taylor et al. and/or Owen et al. as disclosing using a laser and selecting laser fluence to re-deposit debris on a substrate. However, the Examiner does not address the failure of Drazl et al. to disclose or suggest ablation of the surface, and does not address the failure of Drazl et al. to disclose an initiator in the form of precursors of structures formed by ablation of a substrate. Drazl et al. discloses only photodecomposing of organic materials on the surface (column 3, lines 34-36). Drazl et al. does not disclose ablation of the surface itself. In fact, there is absolutely no teaching to modify the teachings of Drazl et al. as the Examiner proposes.

Applicant maintains that the Examiner has failed to demonstrate that the proposed combination is taught or suggested by the cited art. Although the Examiner indicates that it would be obvious to employ the laser of Taylor et al. and/or Owen et al. in order to "reap the benefits of increased surface are for bonding," there is no meaningful teaching in the references of the need for such increased surface area in Drzal (which seeks only to roughen the surface of a substrate), in Taylor et al. (which indicates that a higher fluence is necessary to avoid cone formations), or Owen et al. (which does not even reference formations on the substrate, but rather a plume of debris).

Turning now again to the particular claims, applicants focus initially on claim 1, which recites:

> A method of preparing a surface for adhesion, the method comprising:
> providing an initiator in the form of precursors of structures formed by ablation of a substrate which is configured to shadow a portion of a surface of the substrate;
> directing a laser toward the surface of the substrate to effect ablation of a non-shadowed portion of the substrate, forming structures on the surface of the substrate; and
> applying an adhesive to the surface of the substrate.

As noted generally above, Drzal does not disclose "providing an initiator in the form of precursors of structures formed by ablation of a substrate." In fact, Drzal does not even consider ablation of a substrate. Drzal proposes using UV light to photodecompose organic materials on the surface of a substrate. Taylor et al. and Owen et al. also fail in this regard. Taylor indicates only that "higher fluences will be required to remove cone formation." Owen et al. refers only to an undesirable plume of debris that may be avoided by directing the beam in a pattern.

Drzal also fails to disclose debris (precursors of structures formed by ablation) that "shadow[s] a portion on a surface of the substrate." Applicants note, however, that Drzal does not even disclose ablation. Accordingly, there can not be any ablation debris. Taylor et al. and Owen et al. teach away from the proposed debris that "shadow[s] a portion on a surface of the substrate." Taylor et al. teaches increasing laser fluence to avoid such debris. Owen et al. teaches directing the beam in a pattern to avoid a temporary plume of debris.

Drzal also fails to disclose "ablation of a non-shadowed portion of the substrate." As noted above, Drzal proposes using UV light to photodecompose organic materials on the surface of a substrate. There is no shadowed portion (or un-shadowed portion) affecting formation of structures on the surface of a substrate. Taylor et al. and Owen et al. add nothing in this regard.

For at least the foregoing reasons, claim 1 is allowable over Drzal either alone, or in combination with Taylor et al. and/or Owen et al. Accordingly, the rejection of claim 1 under 35 U.S.C. §103(a) should be withdrawn. Claims 2-5, 7-9 and 33-35 depend from claim 1, and thus are allowable for at least the same reasons as claim 1.

Claim 10 recites:

> A method of preparing a surface for adhesion, the method comprising:
> directing laser radiation towards the surface of the substrate to effect ablation of the substrate and create ablation debris, the ablation debris having a higher ablation threshold than the surface of the substrate;
> resettling the ablation debris on the substrate surface to shadow a portion of the surface from laser radiation;
> further directing laser radiation towards the surface of the substrate at an intensity sufficient to cause ablation of the substrate, but not sufficient to cause substantial ablation of the debris, thereby forming structures on the surface of the substrate.

As noted generally above with respect to claim 1, Drzal et al. fails to disclose "directing laser radiation towards the surface of the substrate to effect ablation of the substrate." Rather, Drzal et al. proposes using UV light to photodecompose organic materials on the surface of a substrate. There is no shadowed portion (or un-shadowed portion) affecting formation of structures on the surface of a substrate. Correspondingly, there is no mention of "ablation debris having a higher ablation

threshold than the surface of the substrate," or of "resettling the ablation debris on the substrate surface to shadow a portion of the surface from laser radiation," as recited in claim 10. Taylor et al. and Owen et al. also fail in this regard. Taylor indicates that "higher fluences will be required to remove cone formation." Owen et al. refers to an undesirable plume of debris that may be avoided by directing the beam in a pattern.

Drzal also fails to disclose a laser having an "intensity sufficient to cause ablation of the substrate, but not sufficient to cause substantial ablation of the debris." Taylor fails to select laser intensity to ablate the substrate (but not the debris) because it calls for removal of the debris. Owen et al. does not even consider such distinction because Owen et al. does not consider debris other than in a plume that Owen et al. seeks to avoid.

For at least the foregoing reasons, claim 10 is allowable over Drzal et al. either alone, or in combination with Taylor et al. and/or Owen et al. The rejection of claim 10 under 35 U.S.C. §103(a) thus should be withdrawn. Claims 11-17 and 36 depend from claim 10, and thus are allowable for at least the same reasons as claim 10.

Claim 18 recites:

> A method of increasing adhesion of an adhesive to a substrate, the method comprising:
> directing a laser at a surface of a substrate to cause ablation of the surface and formation of ablation debris;
> adjusting the fluence of the laser between an ablation threshold of the substrate and an ablation threshold of the ablation debris;
> ablating the surface of the substrate;
> progressively covering the surface of the substrate with ablation debris to effect formation of raised structures on the surface of the substrate; and
> applying an adhesive to the surface of the substrate.

As noted generally above with respect to claims 1 and 10, the cited references (either alone or in combination) fail to disclose "directing a laser at a surface of the substrate to cause ablation of the surface and formation of ablation debris." The references also all fail to disclose "adjusting the fluence of the laser between an ablation threshold of the substrate and an ablation threshold of the ablation debris." Accordingly, the references fail to disclose "progressively covering the surface of the substrate with ablation debris to effect formation of raised structures on the surface of the substrate," as recited in claim 18.

For at least the foregoing reasons, claim 18 is allowable over Drzal et al. either alone, or in combination with Taylor et al. and/or Owen et al. Accordingly, the rejection of claim 18 under 35 U.S.C. §103(b) should be withdrawn. Claims 19 and 20 depend from claim 18, and thus are allowable for at least the same reasons as claim 18.

Claim 21 recites:

> A method of eliminating interfacial failure between a first component and an adhesive in a print cartridge assembly, the method comprising:
> directing a laser at a surface of a first component;
> shadowing a portion of the surface of the first component with precursors of structures formed by ablation of the surface of the first component to form a high threshold ablation region and a low threshold ablation region;
> adjusting the laser to ablate the low threshold ablation region at a rate faster than ablation of the high threshold ablation region in order to form structures on the surface of the first component; and
> applying an adhesive to the surface of the first component.

The cited references fail to disclose "adjusting the laser to ablate the low threshold ablation region at a rate faster than ablation of the high threshold ablation region in order to form structures on the surface of the first component." It also will be

appreciated that the references fail to disclose "shadowing a portion of the surface of the first component with precursors of structures formed by ablation of the surface of the first component to form a high threshold ablation region and a low threshold ablation region." In fact, there is no mention in any reference of ablation of the surface of the substrate to form ablation debris. All of the cited references seek to avoid the effects of ablation debris.

For at least the foregoing reasons, claim 21 is allowable over Drzal et al. either alone, or in combination with Taylor et al. and/or Owen et al. The rejection of claim 21 under 35 U.S.C. §103(b) thus should be withdrawn. Claims 25 and 26 depend from claim 21, and thus are allowable for at least the same reasons as claim 21.

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Conclusion

Applicants believe that this application is now in condition for allowance, in view of the above amendments and remarks. Accordingly, applicants respectfully request that the Examiner issue a Notice of Allowability covering the pending claims. If the Examiner has any questions, or if a telephone interview would in any way advance prosecution of the application, please contact the undersigned attorney of record.

Respectfully submitted,

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CERTIFICATE OF FACSIMILE TRANSMISSION

I hereby certify that this correspondence is being facsimile transmitted to Examiner E. Fuller, Group Art Unit 1762, Commissioner for Patents, at facsimile number (571) 273-8300 on June 12, 2006.

Christie A. Doolittle